

Review Methodology & Questions

FHWA got support from AASHTO to ask detailed information from the State Transportation Agencies to determine the current uses of CIR. From the results of this survey, three states were identified as being among the highest users of the technology, offering us opportunities to learn from those with long term experience and had an aggressive use of CIR on state roads and on major highways. Several states not visited offered information, or reports on their experiences and extent of use of the technology. The states selected were New York, Nevada, and Kansas. These states were visited in order to collect information about the state-of-the-practice on CIR uses. The following maps, and summary of AASHTO's questions to their members represent provide more details to the extent of use as determined by the survey results throughout United States.

The survey questions are included below to help understand the types of information that was gathered.

Cold In-Place Recycling

Federal Highway Administration National Review Review Guide

Purpose

The purpose of this review is to capture for technical deployment the most advanced uses of cold in-place recycling (CIR) and then transfer the knowledge to all State Transportation Agencies (STA). Through this sharing of information, we intend to showcase how other STAs overcame barriers and advanced the routine use of CIR as a pavement rehabilitation strategy. “Best Practices” will be identified along with barriers and benefits. Specifications, construction practices, implementation challenges, and identification of ongoing and completed research will also be documented. This information will then be disseminated to all STAs through technical guidance, written report, training, and guide specifications, as necessary.

Review Methodology

Site Visit Component:

The CIR review involved visiting three different states (NY, NV, KS), meeting with state and industry personnel and some site visits. Additionally, more states will be contacted to provide information on their programs without detailed site visits by the team.

Paper Review Component:

In order to gather as many good practices, performance data, and learn what issues have been overcome, and how the state selects projects it will be necessary to send out a set of questions to several targeted states for request of their input. **This** document is that set of questions to gather as much details as possible for the final report.

Discussion Groups – example of what occurred during the site visits

Discussion groups were used to gain knowledge about different activities and operations. The list of questions we used was similar in format to the attached questions that you are being asked to provide your state's detailed responses. The following is a list of typical discussion groups and representation from the STA that we meet with during the site visits:

- Leadership – Director of Transportation, Chief Engineer, FHWA Division Administrator and staff (Pavement/Material Engineer), various SHA District Engineers.
- Performance, Design, Materials and Research – Pavement Management Engineer, Maintenance Engineers staff, Materials Engineer staff, Pavement Design Engineer staff, and Research Engineer staff.
- Project Administration (they had first-hand experience using CIR) – Project Construction Engineer, Operations or Maintenance Engineer, District Project Engineer, Project Inspections Staff, and Materials Testing Laboratory Technicians.
- Industry - Local Association of General Contractors (AGC) Chapter, CIR and General Contractors, CIR Equipment Manufacturers/Suppliers, and binder material suppliers.

Materials we would like to obtain.

We would like to obtain specific documents that are related to the STA's use of CIR. The following are examples of documents we would like to obtain: (either electronically or paper)

- Pavement management performance data/curves –
 - Network or project level selection criteria – triggers for when CIR would be used, condition level, traffic, extent of maintenance cost?
 - Does the PMS have the ability to select CIR as one of the potential rehab/maintenance methods?
- CIR usage trends – prior use future, and expected use – lane miles?
- Design procedures – process for CIR design, who, how, when.
 - Extent of project evaluation down to select, and then any more testing to confirm CIR is the correct rehab method – field-testing program?
- Specifications – bid information also – how is it bid? Contractor change request to be CIR instead of another process?
- Test Reports – density, quality control in the field, what are controls that the state uses?
- Demonstration/Research reports – any university, in-house reports on the CIR (MS Word, paper copies, download?)
- Experiences learned over time – tips and knowledge type info
 - Changes in bidding
 - Changes in design

- Changes in project selection
 - Specifications changes
- Funding for CIR, sources (federal-aid?) Is there a dedicated funding program for CIR type projects? If so, increasing, decreasing amounts?
- Cost trends – has cost of work for CIR been tracked, and evaluated to cost of other construction costs? Looking at rate trends, if they follow the same as other construction cost? Cost of oil impacted the cost of CIR like it has for HMA (mill/fill)

The following are questions we asked on-site to get some perspective of management's methods of support, how CIR became a valuable tool, what prompted it to happen. Use them to help you think of some of those "why you started to use CIR", and "why" you continued, and about the future of CIR in your state.

Leadership – how does upper management support CIR

1. What is your agency's vision regarding the use of CIR? What is the driving force behind this vision?
 - a. Do you see economic and performance enhancements for the CIR program?
 - i. Can you provide information on the funding, and economics?
 - b. Was there or is there some mandate for recycling, and was CIR part of any mandate?
 - c. Future plans for its use? – What is the vision for the future of CIR?
 - i. What is being used to select projects? Traffic volumes? PMS? Maintenance records? District Engineers? Location?
2. What policies or practices have changed from beginning to support the use of CIR?
3. Do you see any changes in the next five years related to the use of CIR?
4. What is your agency's role in promoting/supporting the use of CIR?
5. What barriers have been overcome to increase the use of CIR?
 - a. Understanding of the process?
 - b. Trial and errors in use?
 - c. Contractor's experiences?
6. What barriers currently exist that prevent increased use of CIR?
 - a. Available projects?

- b. Funding?
 - c. Support in the technology?
 - d. Supply of experienced CIR contractors?
7. What further research, laboratory work or policy initiatives would be needed to advance, or keep using CIR? Are there performance measurements of time to help showcase that issue for CIR?

Performance, Design, Materials, & Research Offices

General

1. Describe the process for selection of potential projects for CIR technology?
 - a) What are the primary reasons that CIR is selected as the rehabilitation strategy?
 - b) What pavement conditions make for the best candidate roadway sections
 - c) What other considerations are taken into account (such as budget, traffic vol, urban vs. rural setting, utilities, number of driveway openings etc.)? Limits in place on candidate projects?
 - d) Field review and testing of in-place conditions done? What do you do to insure the project and rehab is a good match?
2. Is the PMS used to id candidates, and does it utilize specific project type rehab as CIR
3. What types of pavement surface courses are selected? And what criteria does traffic, % trucks, climate, etc. affect surface type.
 - a) What are the design inputs from the CIR layer used for surface design process?
 - b) Structural numbers, gravel eq? Any laboratory work to obtain design numbers?
4. Provide a brief description of various use trends of CIR in your state. (Not just state work but county/city government). Past and future.
5. Please describe any problems that have occurred with CIR operations? What corrective action was performed?
6. When is the decision made about the use of CIR on a particular project? What information is used to make these decisions?
7. Do you use LCCA in rehab/pavement selection process? What are the values for CIR when considered in a life cycle cost analysis?
 - What service life is used for the CIR strategy (with different overlays)?
 - What dollar values are used for construction and residual cost?

8. Has anything in design limited the use of CIR for a project?
 - a) And what was overcome through engineer, research knowledge?
 - b) What is still an issue/concern?
 - c) How do you support the use of Cold In-Place Recycling (CIR) (or recycling methods in general)?
9. What barriers have you overcome in the past, now or future to increase the use of CIR?
10. What barriers currently exist that prevent further use of CIR?
11. What further research, laboratory work, or policy initiatives would be necessary to assist you overcoming barriers?

Project Bidding/Selection and Type of Overlay Selected:

1. Is there a formal project process that is used to bid CIR?
 - a. Who does it, and what type of field adjustments are permitted, and used.
Cores taken?
 - b. Who evaluates the cores and what tests are used? Who selects the binder materials percentages?
2. Is it set up to be CIR project, or can it be an alternate bid? Can Contractors request CIR after the bid, (change order, cost savings proposal?).
3. Has the STA ever offered an incentive or value engineering proposal for the use of CIR?.
4. Do the specifications provide enough latitude for contractors to bid CIR as an option? Or is it pre-selected by state, and if so, what % of the program is CIR used?
 - a. Extent of use, types of roads, traffic volume, rural, urban areas – details on uses.
5. How thick is the existing pavement needed in order to use CIR? (Carry equipment strength) Do you do any field-testing to insure sufficient strength will be in-place for the CIR train? What are the criteria?
6. Are any adjustments made to structural coefficients, layer thicknesses, stiffness values or other parameters in the STA pavement design procedures because CIR is utilized?
7. What is the structural layer coefficient used for the CIR mix? Any thoughts on the mechanistic pavement design method and what to use for CIR?

8. Describe types of wearing/surface course are used? Criteria for selection of surface type (ADT/type of road, what are the triggers?)
9. What is done for timing to overlay? Residual moisture and the cure out of water used in the CIR process. Discuss the % moisture, and specs as well as actual field experiences.
Rain during and soon after CIR is always an issue, specs, issues, and experiences from rainfall.

Equipment Specifications:

1. Do you specify the types of equipment to be used?
2. Do you provide specifications for performance, requirements for electronic measurements devices to be used/required?
3. Discuss your equipment that is used on the jobs, and reasons for them to be used. Pros and cons of the various CIR equipment you have experience with.

Materials

1. What are the materials requirements?
 - a. Allowable binders/recycling agents?
 - b. Most/common used?
 - c. Any research on new materials? (foamed asphalt, Engineered emulsions?)
2. What mix design process do you use?
 - a) What assessment of the existing pavement is conducted to determine the CIR design (gradations, binder content, VTM, VFA, VMA, field compaction, recovered asphalt properties, etc.)?
 - b) How is the RAP evaluated?
 - c) Do you consider the addition of new aggregate, or RAP? Experience in using add stone.
 - Are they coated, and what are the specs on the “add stone”?
 - d) How is the optimal recycling or binder additive content established?
 - e) How/Who selects the type of recycling of binder additive? Contractor input, industry material supplier, state research/specs?
 - f) What type of testing is done to determine cure properties and strength properties?
 - g) Lab density and field density – what process to correlate the two, and test in the field? Compaction concerns?
3. What field sampling and testing is required for control? QC/QA process, additives, recycling agent.

4. Please describe your CIR project specifications and requirements? Or is your spec performance based?
 - h) Treatment depth allowed?
 - i) Recycling agents allowed?
 - j) Maximum size of RAP?
 - k) Type of Equipment trains allowed?
 - l) Requirements for compaction effort? How measured or controlled?
 - m) Timeframes for curing prior to overlay? Any differences for type of overlay used?
 - n) Overlap requirements for multiple passes? How do you handle the overlap in width? (Turn off the additive/binder?)
5. Any use or consideration of using warranties to insure the long-term performance.
 - a. Provide examples if any. Is it giving you what you want?

Pavement Management & Research

1. Have you perform any FWD testing to measure resilient modulus, retained strength over time on CIR projects?
2. Are there any particular distresses observed in the CIR projects over time? Information of long-term performance is needed for report. Do you have data, research finds to document performance?
3. What is the typical form of distress that triggers rehabilitation or reconstruction of your roads?
4. Have you developed any performance curves for CIR projects? Copy available?
5. Rehab of any old CIR project been done, or what would be considered as rehab selection for an existing CIR project? What happens next on older CIR projects?

Research

1. Have you had any issues that have resulted into a research project?
2. What demo, case studies, or research projects have been performed? Copies of reports?.
3. Historically information on project performances, maintenance needs?
4. Traffic data, environmental concerns factored into LCCA or service life?

Construction Engineers and Staff

1. How do you support the use of Cold In-Place Recycling (CIR)? Help in selecting rehab method and actual projects?
2. What barriers have you in the field overcome to increase the use of CIR?
3. What barriers currently exist that you see that is preventing further or more use of CIR?
 - o) Equipment mobilization/parking/storage?
 - p) Roadway geometrics?
 - q) Break times?
 - r) Curing times?
 - s) Seasonal issues?
 - t) Maintenance of traffic issues?
 - u) Existing pavement structure?
4. What further research, laboratory work, or policy initiatives would be necessary to help in overcoming barriers in use?
5. Describe the different CIR operations you have experienced.
 - a. What types of equipment trains are typically used? Allowed?
6. Where are your typical contractors located that bid on CIR projects?
7. Provide a brief description of various markets for CIR in your work area and recent usage and pricing trends. How does this compare with other rehabilitation strategies?
8. Involved in gather data for any ongoing, or completed research/demonstration projects?
9. Describe any instances where the use of CIR was considered but not done in a project and the circumstances of the situation.
10. Provide details on any problems that have occurred using CIR. Describe any corrective actions, monitoring and follow-up to address any problems or concerns.
11. How are field adjustments made to the mix design in the field?
12. What is the spec on compaction, and how is compaction effort controlled?
13. What quality assurance procedures (Field inspection process) are employed to monitor the CIR project? Is there a required field sampling and testing program, describe what is done.

Next questions are about the CIR industry and what has and is being done to support the industry, and how you are partnering with them for CIR program.

If you want the local CIR industry provide any comments on what they did to help in overcoming barriers for the CIR program, or any ideas on what will increase it use, barriers or issues needing work? Please do so.

1. Do you have an active partnership with the CIR contractors?
2. Do they meet with you to discuss any specifications, design changes?
3. Were they involved in the early work on getting CIR going?
4. Do you think their involvement was one reason for you to have a CIR program?
5. Any annual type meetings with CIR contractors? Or is it general contractor meetings?
6. Any comments on how the CIR contractors helped you begin a CIR program?
7. Any actions from them that helped improve the overall process?
8. Any future actions that they can be helping improve CIR process?

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CIR Review Timeline:

- October 2004 - 1st Draft version of the CIR Survey was developed.
- November 2004 - CIR Survey was sent out through SOM
- April 2005 - 1st FHWA Review Guide was developed
- July 11-14, 2005 – NY review was conducted.
- August 22-26, 2005 – NV review was conducted.
- November 14-17, 2005 – KS review was conducted.